SCIENCE

OL. 91 | FRIDAY, MARCH 29, 1940 | No. 2361

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS
New York City: Grand Central Terminal
Lancaster, Pa. Garrison, N. Y.

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

EPISODES AND PERSONALITIES IN THE DEVELOPMENT OF BIOLOGY AT BROWN[1]

By Dr. A. D. MEAD

BROWN UNIVERSITY

IN the diamond jubilee number of the *Atlantic onthly,* issued in November, 1932, seventeen articles elected from the 900 monthly issues of the *Atlantic* ere reprinted. One of them was Dallas Lore Sharp's amous paper on "Turtle Eggs for Agassiz" (1910), hich already had been reprinted many times and hich, incidentally, has been read by Dr. Walter to is class in comparative anatomy in Brown every year or a quarter of a century. Now this touches my bject at several points: The hero of the episode was . W. P. Jenks, the first teacher of zoology at Brown. enks was a lifelong disciple of Agassiz and widely isseminated his doctrines at Brown and elsewhere. harp was a student at Brown (1895) and a special protégé of Professor Jenks, from whom, while at Brown, he got the tale about the turtle eggs. Again, Sharp's own colorful career at Brown, if as adequately written up, would win a place in literature. And finally, his introduction to the turtle egg paper provides the theme, which is at least implied, of this post-prandial talk, namely, that the progress of a science in a period of years, like a game of golf in an afternoon, is not completely recorded in the mere enumeration of the end results and the scores, but that personalities and minor dramatic incidents are a vital and substantial part of the story.

Sharp found the clue to his story in Agassiz's four volumes of "Contributions to the Natural History of the United States." "The volumes," he said, were "massive, heavy, weathered as if dug from the rocks,"

[1] Address at the dinner of the National Academy of ciences, Brown University, October 24, 1939.

a "laminated pile . . . a kind of printed coral reef." One volume contained a monumental work on turtles and their embryology. "I turned away from the weary learning to read the preface," says Sharp. There he found the brief acknowledgment of Jenks's assistance in furnishing turtles and eggs in early stages, and "all there is to show for it, so far as I could discover, is a sectional drawing of a bit of the mesoblastic layer of one of the eggs!"

"Of course Agassiz wanted to make that mesoblastic drawing and had to have a fresh turtle egg. I'm glad he got it. But what makes me so sad and impatient is that he did not think it worth while to tell about the getting of it and so made only a learned turtle book about what might have been an exceedingly interesting human book." Then follows the thrilling tale of getting those fresh eggs which the turtle laid for Jenks—as though upon special order at four o'clock one Sunday morning—from a pond near Middleboro to the great man at Cambridge forty miles away; a tale which, for dramatic and exciting incident, puts Sheridan's ride completely in the shade. What Agassiz, in Sharp's view, neglected, Sharp did superlatively well. He proved his point. And mine too!

However, in justice to Agassiz, it must be said that, if he did miss a human story, Sharp missed an even greater story in the same dull volumes from whose "weary learning" he "turned away with a sigh," for there was Agassiz's *Opus Magnum,* his mature interpretation of living nature, the famous "Essay on Classification." And as to the despised bit of mesoblastic layer of one of the eggs, it had not, after all, been buried in this laminated coral reef, as Sharp calls the heavy old volumes, but it had been rescued long before and formally presented by Agassiz himself to the élite of Boston at one of the Lowell Lectures, and then gallantly escorted into the *Atlantic Monthly,*[2] a veritable Cinderella, to live happily in the palace among the little princes of literature ever after.

Professor Jenks[3] came to Brown in 1871, at the invitation of President Alexis Caswell, one of the founders of this National Academy, commissioned to establish immediately a museum through which to teach Agassiz's bio-theological doctrines. Evidently the ground was well prepared for him, for the student magazine, *The Brunonian,* of April, 1870, had said: "A cabinet of comparative anatomy is essential to any college. . . . Every plant and animal is an expressed thought of God and can not be presented through the medium of a professor!" As the Brown historian, Professor Bronson, observes, "those thoughts of God for whom professors are no substitute were soon to be supplied." Within a year several thousands of specimens of notable variety were acquired through Jenks's initiative.

In 1876, by invitation, Jenks prepared the well-known text-book "Fourteen Weeks in Zoology" in Steele's Scientific Series of text-books on the natural sciences. In this he found occasion to promulgate widely the views of his mentor, Louis Agassiz, relative to the theory of design, the subservience of all creation to man, and the explanation of morphological resemblances. In one of the revisions of this book Jenks employed an assistant who had become tainted with evolutionary ideas by Professor Packard, then at Brown. He particularly cautioned the assistant to retain the statement of what the hippopotamus was designed for: "It is exactly fitted to dredge the rivers and keep open the channels, so apt to become filled with the luxuriant growth of that tropical region"—Africa. Whereupon the reluctant and impertinent Bumpus countered the injunction with the query, "Shall I then say the beaver was exactly fitted to dam up the rivers of North America?" Of the position of man and of morphological resemblances the text said: "Man—the lord of the Animal Kingdom—is constructed after the same type as the cat which purrs at his feet, the ox which he eats, the horse which bears his burden, the bird which sings in his gilded cage, the snake which crawls hissing across his pathway, the toad which hides in his garden, and the fish which swims in his aquarium. All are modifications of one creative thought, showing how the Almighty Worker delights in repeating the same chord, with infinite variations."

It is, I think, significant of the long-continuing hold of Agassiz's doctrines upon the laity that, as late as 1889, the Chautauqua Assembly adopted this text-book by Jenks and took over for distribution 30,000 copies of it. The paragraph about the hippopotamus, alas, was emasculated, but the one about "Man—the lord of the Animal Kingdom" passed through the ordeal unscathed.

Because Jenks was here, the ontogeny of biological work at Brown the better epitomizes the progress of biological thought in the country generally. Agassiz made an epoch. Jenks represented this epoch at Brown.

Alpheus Spring Packard, a student of Louis Agassiz, came to Brown in 1878. He was to the academic manner born, his father, a distinguished professor of Latin and Greek at Bowdoin, his mother, the daughter of the president of the college.

He was a typical boy naturalist, that lovable combination of grave maturity of purpose and natural boyishness. In his diary at the age of sixteen he records his decent pleasure in discovering for himself

[2] 1862.

[3] John Whipple Potter Jenks, Curator of the Museum of Natural History from 1871, professor of agricultural zoology from 1875 to 1894.

and reading the lives of Cuvier and Lamarck and, in almost the next entry, really lets himself go: "February 5, 1855. I have read a good deal to-day in my Naturalists' Library. Oh, that I could wander around the earth to collect specimens of Natural History! It seems to me that if I could know all about botany, mineralogy, geology and conchology, and knew how to stuff animals and birds, and to preserve insects and keep shells, that nothing could be more pleasant, provided that I had the *finances.*" In good time, as we know, his heart's desire was to be satisfied. He traveled widely, was a prolific writer, was honored at home and abroad, was elected to this academy at the age of thirty-three on nomination of Louis Agassiz, and was elected as foreign member of the Entomological and Linnean Societies of London—and, he had "the finances." He was, however, at heart a boy naturalist to the end of his days.

As junior colleague, I was privileged to know Packard at Brown for nearly ten years. In my recollection he spent little time on the campus and in the laboratory except at lecture periods. He evidently prepared some 300 of his 579 printed works mostly at his home on Angell Street. Visits to his home were a continual revelation. Book shelves in every room groaning under the weight of scientific books and journals, sideboards, cabinets and bureau drawers all over the house, hospitably entertaining thousands of his precious insects, all testified to the admiring, affectionate and long-suffering devotion of his wife and daughters.

The Packard régime overlapped that of Jenks, but there was no genetic relation between them. They were distinctly different in their conceptions of what biology was all about and in their ideas of scholarship and of teaching. Packard and Jenks were on friendly terms and took long trips together, but in academic matters each went his separate way.

What I might call the Recent or Cenozoic Era in the history of biology at Brown had, likewise, little if any genetic relation to the régime of either Jenks or Packard, although it overlapped them both—one by four years, the other by fourteen. The new era dawned suddenly in 1890 and at once took on a clearly defined character which has not changed essentially in these forty-nine years. This character was determined by a curious combination or concatenation of events which would seem in the recital of them to have no connection, but which, altogether, conduced to this one end. I refer to the founding, in 1888, of Clark University, the founding of the Marine Biological Laboratory at Woods Hole in 1888, and to the advent of E. Benjamin Andrews as president of Brown in 1889.

To be more explicit, as the first president of Clark University, Dr. G. Stanley Hall had, of course, brought to Clark from the Johns Hopkins the ideals of scientific scholarship for which that institution was so well known, and he had assembled at Clark a notable group of leading scholars in biology as well as in the other sciences—Whitman, Donaldson, Mall, Baur,[4] Watase, McMurrich, Wheeler, Jordan, Lillie and others. The Marine Biological Laboratory, as you know, was the spiritual descendant and legatee of the laboratories at Penikese and at Annisquam and, from its start, was the Mecca of American biologists. At Clark and at the Marine Biological Laboratory, there was represented the best scholarship of America and Europe in the field of biology and, at both, the informal and close association of professors and students, young and old, in the laboratories day in and day out, was a feature of vast importance. President Andrews, in his first annual address to the corporation in June, 1890, had already declared his aggressive educational policy and had begun to put it into effect, namely, the positive encouragement of learning by what later the ritual of Sigma Xi was to call "companionship in zealous research," and the definite and formal establishment of graduate work at Brown for its favorable effect upon the undergraduate teaching and upon the intellectual atmosphere of the campus. He said: "Nothing in the world would so inspire our undergraduates . . . as the presence upon these grounds of a few score of graduate students pursuing and discussing their advanced studies and conducting special researches in our library and laboratories, and nothing else could so spur our faculty to that enterprise which is imperative, as to have to direct and examine investigations in these higher fields."

In the autumn of 1890, Dr. H. C. Bumpus, a Brown graduate, was summoned from Clark and the Marine Biological Laboratory where he had been since these two institutions opened their doors. He was specifically commissioned by Andrews to put these declared policies into effect as far as biology was concerned. By virtue of his baptism by immersion (orthodox at Brown) in the atmosphere of Clark and the Marine Biological Laboratory, Bumpus was "exactly fitted" to carry out this commission.

When he arrived, at the beginning of the college year, he brought with him from Woods Hole one graduate student, a green youth from the Green Mountain State—a sort of nest egg, whose presence was a faintly perceptible adumbration of coming events in graduate work. As capital to work with he had inexhaustible energy, unsinkable optimism and the hearty endorsement of the president. He needed to have laboratory space, equipment and apparatus, books, current and back issues of biological periodicals and financial support to help hold together, temporarily, the bodies and souls of a few prospective graduate students. These things the university, through its president, would fain have provided, but could not.

[4] Paleontology.

However, it never occurred to Bumpus to be sorry for himself. He had in Necessity, the fertile mother of Invention, a strong ally. She fairly spawned inventions and devices for overcoming the difficulties and making good the deficiencies. In a short few years a department of biological work, such as Andrews had envisioned, was realized and was functioning.

What this triumvirate—Andrews, Bumpus and Necessity—was able to get done in the first ten years, the episodes, escapades and personalities involved, would strain the capacity of a semester course to relate. I call them a triumvirate, aware of the abundant evidence that "necessity" is feminine. They needed space in a building already crowded. Some was acquired by the dubious right of eminent domain; much of it was created. If creation of space seems incredible, your physicist colleague, Dr. Frederick Keyes, will substantiate the claim, for, some years later, in a part of this "created" space in Rhode Island Hall, Keyes, having temporarily turned biologist for diplomatic reasons, set up his anastomosing labyrinth of glass tubing and began some initial experiments. And it is because, elsewhere, he followed up the matter so carefully that now he's a member of the academy.

A very creditable library of biological books and journals was soon assembled which, each summer, was taken to Woods Hole, along with the whole department staff and graduate students, and there for several years constituted practically the library of the Marine Biological Laboratory. In the quest for moral and financial support a visiting committee consisting of physicians and friends was invented—long before it was imitated elsewhere—which, through the years, contributed several hundred thousands of dollars to the support of biological work.

The scope of the department was extended as general physiology, bio-chemistry and bacteriology pressed for recognition. Tower and Gorham, the young instructors who had built the elementary "cat course," were picked for these purposes. Ralph Tower was sent abroad to study modern physiology and, returning, to establish it in the department. Frederick P. Gorham, after submitting a thesis on the development of the egg of the shrimp—perhaps not because of it—was metamorphosed into the bacteriologist of the family. This was not so irregular as might appear, for at practically the same time, E. O. Jordan, afterward the veteran chief of bacteriology at the University of Chicago and a member of your academy, was submitting his doctor's thesis on the development of the egg of a salamander. Bacteriology was only in about the "two-cell stage" of development in those days. It developed here rapidly and soon the cooperation between the university and the city through Gorham and the Superintendent of Health, Dr. Charles V. Chapin, was perfected. Each supplemented the other and their accomplishments are of immeasurable value not only to the city and the state but to the science and the art of public health everywhere. Dr. Chapin, for many years professor of physiology at Brown, is, happily, a prophet not without honor *even* in his own country, the hospital which bears the imprint of his genius also bears his name, the Charles V. Chapin Hospital. This recalls a brilliant suggestion by a student which is recorded in Dr. Walter's "Anthology of Student Responses," "The City hospital treats contagious and genealogical diseases"—a suggestion of singular appropriateness in this old and aristocratic community.

The establishment by the "Triumvirate" of the houseboat floating laboratory on Narragansett Bay in cooperation with the state, the establishment of the pathological laboratory at the Rhode Island Hospital, the restitution of scientific work, which Baird had first established, at the United States Fish Commission at Woods Hole, the setting up in the biological laboratory at Brown of the first x-ray machine in the state, and its pioneer employment in morphological research, and the subsequent installation of the first x-ray equipment at the Rhode Island Hospital, we must pass over. Many other enterprises, full of incident and personality, can not even be read by title.

Andrews and Bumpus came in with the decade and went out with the decade, the one to Chicago, the other to New York. Necessity stayed. The biological establishment continued and still continues to develop and grow and mature, although the personnel and the biological fashions change.

As I have been thinking on these things I have wondered how far the story of biological work at Brown is typical of that in other American colleges. I have wondered also whether, in these days of sophistication and relatively luxurious equipment, episodes and personalities do, or will ever again, play anything like the role which they played in the pioneer period from 1870 to 1900. The biologists in your academy, of course, could answer both these questions far better than I can. I suppose that the experience at Brown is fairly typical of that in such colleges of the eastern section of the country as were going concerns seventy years ago.

Be that as it may, Brown early felt the full impact of Agassiz's powerful personality and teachings. In Packard, Brown fortunately had a member of that extraordinary group of men, including Morse, Hyatt, Putnam and Verrill, who, having studied with Agassiz, broke away from him and became acknowledged leaders in evolutionary interpretation of biology. In retrospect it is clear also that, in the coming of Bumpus, Brown was involved immediately in that network of

circumstances, or perhaps coincidences, that seemed to just happen in 1888–89 and centered in the opening of Clark University and the Marine Biological Laboratory at Woods Hole. Through the personnel of these institutions directly, and through the Johns Hopkins University indirectly, Brown was in close touch with European biological ideas; especially German. Ideals of the German scholarship of that time were then grafted upon those of an old American college of English descent and this new thing was grown in an atmosphere of academic democracy engendered by the great emphasis upon life in the laboratory.

I have mentioned only those persons who have gone from us forever, or who, like myself, are academically extinct. I have talked only of the biological work at Brown in its formative stages; the post-larval development is another chapter. In its personnel and its increasingly effective work under the unwritten constitution of 1889–90, we old-timers all take parental satisfaction.

FUNCTIONS OF THE PRECLINICAL SCIENCES IN MEDICAL EDUCATION[1]

By Dr. MAGNUS INGSTRUP GREGERSEN

PROFESSOR OF PHYSIOLOGY, COLLEGE OF PHYSICIANS AND SURGEONS, COLUMBIA UNIVERSITY

WITH war raging in Europe, there is a tendency for all of us to feel an oppressive sense of futility in taking up our academic duties. College presidents and deans the country over have in their addresses before faculties and students been trying to counteract this tendency. But events that represented a potential threat to our existence can not easily be banished from our minds. Whether or not we become directly involved in the conflict, there is, as Park Commissioner Robert Moses[2] recently stated in an address before Union College students, "a mental and spiritual cost of war, as irremediable as other costs." Further, that "Unless we strongly will it otherwise, an oppressive cloud blacks out every non-military usefulness" of our minds. With such distractions, it is all the more important to do what we should always do, namely, pause now and again to clarify our aims and try to find out if our efforts are directed effectively in achieving the ends we desire. This morning it is my privilege to discuss some of the functions of the preclinical sciences in medical education.

The general purpose of a medical school is to train physicians and surgeons. Because this training is constantly undergoing changes resulting from advances made in experimental medicine and its allied sciences, the student must realize at the start that his task is to obtain a foundation which will not crumble under these advances. He must develop the capacity to alter his concepts according to new facts, and establish the habit of assimilating these facts in such a way that they will increase his confidence in his own resources even as he finds some of his earlier training misconceived. Much of what he will learn rests upon insecure experimental evidence—is indeed empirical. Other phases of his work will be well founded. He must learn to distinguish between the two. This he can do only by drawing his own conclusions from what he regards, after careful consideration, to be well-established facts. Such a scientific attitude, acquired early and practiced throughout his course, is the student's most valuable weapon for his medical training.

A large part of the medical course is devoted to scientific studies in which the student has no direct contact with the patient. These studies are designed to give a thorough understanding of the normal structure and function of the human body. For this purpose medical schools support large faculties and expensive laboratories, both for teaching and for research. It is apparent that such establishments would not be required if their services to the schools consisted only in imparting to students a measure of factual information. This could be accomplished by lectures, supplemented by text-books and demonstrations—a method generally employed not so many years ago.

The emphasis on research in preclinical departments is often a subject of speculation if not outright criticism by those who do not fully understand the relation of these sciences to experimental medicine and to the intent of medical faculties in training students. I must remind you that the ultimate goal of medicine is to gain mastery over living processes, in order that these processes may be directed to the welfare of the patient. If therapy is to emerge completely from the realm of the empirical to that of rational scientific procedure, it will do so only when all the factors that govern the normal structure and function of the body are understood. Such understanding is, of course, the ultimate goal of investigators in the preclinical sciences. It is hardly surprising, therefore, that they should be supported and encouraged with as much vigor as those who study abnormal structure and function.

[1] Delivered at the opening exercises, College of Physicians and Surgeons, Columbia University, September 27, 1939.

[2] Quoted from an editorial in *The New York Times*, Sunday, September 24, 1939.

Furthermore, the spirit of research has a vitalizing effect on the teaching staff. Instructors who are themselves engaged in widening the horizon of science can scarcely lose sight of the need for continually revising interpretations and theories in the light of new facts. Their presentation of last-minute discoveries and theories is not, however, as important as the experimental attitude of mind which they can impart to the student. The experimental method aims to correlate observed phenomena by establishing their true relation with respect to cause and effect. The order of the steps by which this is accomplished may vary, but there are three essential parts to the process: (1) the observation of facts; (2) the idea or concept of their relationship and (3) the experimental proof. The man engaged in research knows that his interpretations are likely to be correct only in so far as his observations are true. Therefore, his first concern in teaching is that the student learn to observe accurately and to evaluate facts carefully. Recognizing also that facts without ideas are sterile, he encourages the student to assemble the facts into concepts, that is, to interpret them. Whether or not such concepts are in the beginning correct is immaterial, provided they are subjected to analysis or defended in discussions. An erroneous hypothesis or explanation originated by the student is often most instructive to him in demonstrating the value of the experimental method and in revealing the weakness of unsupported ideas. By stressing this experimental attitude in teaching medical students, the preclinical sciences fulfill their most important function in medical education.

The part of the laboratory in this scheme is apparent. As we have already pointed out, the aim is to train the student to make his own observations, in order that these may form the groundwork upon which he builds his knowledge. In many instances the technics he employs are also to be his tools in clinical studies, and it is important that he examine them critically with respect to their validity and limitations. Above all, the purpose is to establish confidence in his power to observe and to reason correctly from his observations. This can only be accomplished by practicing the experimental method; it can not be taken over ready-made from the text-books. I regret that this concept of the function of laboratory work is not infrequently neglected by instructors as well as students. The tendency is to regard the laboratory simply as an aid to the memory by reviewing material which has already been delivered in lecture or text-book. Such a procedure may be successful in stuffing the mind with information until examinations have been passed, but the information rarely remains as useful knowledge for long because it was not assimilated with the inner conviction which comes only from subjecting it to critical analysis.

A phase of the teaching in the preclinical sciences about which there is a difference of opinion is the writing of theses based on the reading of original scientific articles. Scientific literature is vast; without some early training in dealing with it, this source of information may be neglected by the clinician. Practice in finding one's way in it, learning to get the gist of articles without great waste of time, is a necessary part of the medical training. At least the student should be acquainted with the abstract journals that cover the scientific literature in which he is likely later on to find information related to his principal interest in medicine. Furthermore, students who depend solely upon text-books miss the flavor of scientific inquiry. I have watched with satisfaction the change in attitude which a student often develops towards his text-books after writing a thesis. The assembling of facts and opinions from different sources and the arranging of the information into a well-organized review of his own gives the student a critical appreciation of the element of personal judgment and selection that enters into the writing of any text-book. The very fact that he soon reaches a point in his reading of original articles where some aspect of his subject is under controversy stimulates him to form his own opinions, perhaps to originate an idea. These ideas are frequently the germs that develop into important contributions to medical science.

If the views I have expressed apply to undergraduate work, they apply with even greater force to post-graduate medical teaching in which the preclinical departments are expected to take part. The graduates have behind them years of academic work filled with text-books and lectures. Simply to give them more lectures or other forms of didactic teaching is, in my estimation, to repeat the mistake which has already been made in their basic science training. The experience that will help them in their specialties is the experience which only the practice of the experimental method in the laboratory can give them. That this work should be in the nature of research is perhaps not necessary, but it certainly seems preferable because of the stimulating effect of trying to solve the problems of normal structure and function underlying the post-graduate student's special field in medicine.

Compared with the average college course, the medical curriculum makes heavy demands upon the student's capacity to learn. How to help him to make the fullest use of his mental endowments and to keep him from becoming confused and swamped is a problem that falls mainly to the lot of the preclinical departments which he meets in his first year. The order and arrangement of courses, starting with the study of structure (gross, microscopic and neuroanatomy) followed by the study of function (physiology and biochemistry) is designed to reduce the student's difficulty

as much as possible. Nevertheless, the task is not an easy one, and the student sometimes becomes discouraged because he finds so much to be learned that appears to be quite remote from the practice of medicine, which after all is his goal.

Now, a student might attack the bewildering amount of material before him by setting out to memorize facts—some people can achieve extraordinary memory feats. There is, however, a limit to which this process can go, for so far as I am aware, no one has ever been able to memorize everything in the medical course or even within a single subject of this course. Furthermore, as we have noted above, isolated facts, that is, facts unconnected by ideas, may be quite useless even in an examination where it is usually necessary to employ the facts to demonstrate a new relationship, that is to solve a problem. A "memorizer" soon fails in such a test.

The aim is not only to know but to understand, and understanding introduces the element of relationships. I have often remarked to students that they should be resistant to information, a comment which usually meets with disapproving looks from my colleagues. But a resistant attitude has this virtue, that the holder of it will take the trouble to examine information, no matter what its source, first with respect to whether or not it is true, and second with respect to its relation to other facts. When he has done this, he has also fixed the idea in his mind without just memorizing blindly. This habit is excessively helpful to my memory (which, I regret to say, had its edge worn off long ago in taxonomic botany), and you will find that it saves you the trouble of having your mind cluttered up with uncorrelated information that fails to come out in the order in which you may happen to need it.

I can not emphasize too strongly the necessity of correlating facts from the very start of your course. Don't be too ambitious and expect to see or be shown at once the relation of each detail to the practice of medicine. You can not start at both ends at once. Begin with the small circle of facts under immediate observation and let the extent of your attempts to correlate grow with your acquisition of knowledge. Gradually will come general principles which will serve to simplify the learning process for you, and which if based on sound evidence will stand you in good stead later for purposes of deductive reasoning.

The problem of how to correlate and integrate medical training is a matter of deep concern to your instructors. The faculty is constantly trying to improve the coordination of subjects taught by rearranging schedules, adjusting hours allotted to each course, changing the sequence of courses and even reorganizing the courses themselves to parallel the sequence within others. Unfortunately, no matter how perfect the organization, it can not run itself nor be a substitute for education. Learning is an *active* process in the student's mind; knowledge can not be fed painlessly by the establishment of an ideal sequence. If learning is to be an intellectual process (the process of understanding), the student must take the initiative. He must contribute something himself besides the effort made to retain the information in his memory. What is this contribution? When an idea passes from my mind to yours, it is set up in a new environment which colors the idea, gives it a slightly different meaning, because you may see it in special relations to other ideas determined by your past training and experience. By letting your own mind act on the idea, you have engaged in an intellectual process; that is the contribution which only you can make to your education. No instructor can do it for you. The instructor can expose you to facts and he can give them meaning by indicating some of their relations to each other and their future importance to your work. By so doing, he enlarges your understanding, but he hopes especially to increase your incentive to acquire knowledge.

The stimulation of the student's will-to-learn is the chief purpose in the instructor's mind when he points out here and there the practical application of certain facts in your scientific training to medical and surgical problems. In my opinion, one must beware of devoting too much time to this approach in the preclinical courses, for it is likely to result in focusing the student's attention upon specific facts that happen to be of immediate practical value rather than upon the significance of a knowledge of the science as a whole. What has been done in this school in the correlation clinics for first-year students represents a subtle but important difference in attitude from that customarily assumed. The clinic is given by a specialist in some branch of medicine or surgery, who takes up a clinical problem, analyzes it from the anatomical, physiological or biochemical point of view, and demonstrates how this analysis aids him in solving the problem. You will note that the emphasis in these clinics is not upon application of a specific fact or facts, but upon the methods and the power of reasoning acquired by a broad knowledge of the preclinical sciences.

In concluding, I wish to call your attention to a guiding principle stressed by Claude Bernard,[3] a French scientist renowned for his great contributions to physiology and experimental medicine. He states "that it is essential to distinguish between two things in experimental criticism: experimental fact and its interpretation. Science requires us first of all to agree on fact, because that is the basis on which we must reason. As to interpretations and ideas, they may

[3] Claude Bernard, "An Introduction to the Study of Experimental Medicine," p. 189. The Macmillan Company, 1927. Translation by Henry Copley Greene.

vary, and discussing them is an actual advantage, because such discussion leads us to make other investigations and to undertake new experiments." Failure to observe this difference between fact and interpretation has been the cause of many needless and bitter personal controversies, and indeed it may affect seriously the relation between the students and their instructors. You will find that there are contradictions in the opinions and interpretations of instructors in different departments or even in the same department. These need not be a source of confusion, provided, as Claude Bernard says, we agree on the facts. There are professors who unintentionally perhaps impress their own opinions upon students with such authority that these opinions are regarded as unalterable facts. All of us must guard against this tendency, for nothing is more destructive to the freedom of thought, ingenuity and creative thinking of the student, the very qualities we are eager to encourage. The student must never feel that he will be penalized for expressing an honest well-founded contrary opinion in our midst. Let it also be said that the student must examine his own motives to be sure that they are not simply a desire to contradict, but an earnest seeking after the truth. In that spirit only can academic freedom and freedom of speech be kept alive in our universities.

SCIENTIFIC EVENTS

NEW FELLOWS OF THE ROYAL SOCIETY OF EDINBURGH

ACCORDING to a report in *Nature,* the following have been elected fellows of the Royal Society of Edinburgh: E. B. Ball, president of the Institution of Mechanical Engineers; J. Bowman, city water engineer, Edinburgh; B. S. Bramwell, advocate, London; J. Brough, lecturer in vertebrate zoology, University of Edinburgh; Dr. A. F. Buchan, teacher of mathematics, James Gillespie's School, Edinburgh; J. M. Caie, deputy secretary, Department of Agriculture for Scotland; J. Cameron, formerly head of the Pharmaceutical Department, Peiping Union Medical College; Professor J. W. Cook, department of chemistry, University of Glasgow; Dr. J. Coutts, lecturer in pharmaceutics and demonstrator in practical pharmacy, St. Bartholomew's Hospital Medical College, London; Satchidinanda Datta, veterinary research officer, Imperial Veterinary Research Institute, Calcutta; Dr. T. Elder Dickson, art master, George Watson's Ladies College, Edinburgh; Dr. A. T. J. Dollar, assistant in the department of geology, University of Glasgow; Dr. H. I. Drever, assistant in the department of geology, University of St. Andrews; W. McC. Harrowes, medical director, New Saughton Hall Private Mental Hospital, Polton, Midlothian; T. Hart, collector of the Trades House of Glasgow; Professor C. F. W. Illingworth, department of surgery, University of Glasgow; J. G. Kyd, registrar-general for Scotland; P. R. Laird, secretary to Department of Agriculture for Scotland; Dr. Robert McAdam, lecturer in mining and surveying, Heriot-Watt College, Edinburgh; Dr. J. A. Macdonald, lecturer in botany, University of St. Andrews; Dr. A. E. W. McLachlan, clinical medical officer, Newcastle General Hospital, Newcastle-upon-Tyne; Dr. A. MacNiven, physician superintendent, Royal Mental Hospital, Glasgow; Professor G. F. Marrian, department of chemistry in relation to medicine, University of Edinburgh; Dr. E. R. A. Merewether, H.M. medical inspector of factories, Birmingham; R. M. Neill, senior lecturer in zoology, University of Aberdeen; Dr. H. B. Nisbet, lecturer in chemistry, Heriot-Watt College, Edinburgh; J. S. C. Reid, solicitor-general for Scotland; H. Riley, founder and head master of Strathallan School, Forgandenny, Perthshire; J. Thomson, distiller, London; Dr. H. M. Traquair, president of the Royal College of Surgeons of Edinburgh, lecturer on diseases of the eye, University of Edinburgh.

THE DETROIT CENTER OF THE UNIVERSITY OF MICHIGAN

FINAL arrangements for the construction of a building to cost $1,500,000 in the art center group in Detroit that will serve as permanent headquarters for the Engineering Society of Detroit and the University of Michigan Extension Service have been made. A memorial to the public spirit and philanthropy of the late Horace H. Rackham and of Mary A. Rackham, it will be known as the Horace H. Rackham Educational Memorial, will combine professional, scientific and educational activities.

The building will be located on the south side of Farnsworth Avenue, facing the Detroit Institute of Arts and diagonally across from the Detroit Public Library. Construction will begin early in 1940.

The exterior of white limestone, with marble spandrels and simple ornamental carvings, will house three distinct units of the building. The central section will be an auditorium, seating 1,000 persons, which will be at the disposal of both the society and the university. It will be flanked on the east by a wing housing the Engineering Society and on the west by a wing devoted to the University's Extension Service. The entire memorial will be 404 feet in length and will vary in depth from 150 feet at the center to 65 feet at the ends.

Three floors are provided in the wing of the Engi-

neering Society. It will have approximately 45,000 square feet of floor space and has been carefully planned to provide facilities for scientific, professional and social activities of the society, and its affiliated societies. The university wing, of about 40,000 square feet floor space, will be devoted to classrooms for approximately 1,000 students and offices for the Extension Service and the Institute of Public and Social Administration of the university. It will house seminar rooms, special lecture rooms equipped for scientific demonstrations and a studio and control room to be used in radio broadcasting classes. The library will be housed in a second floor room over the entrance of the Memorial Auditorium. The new headquarters for the Extension Service will bring together in one central place the extensive educational program in Detroit of the university. The Extension Service offers between fifty and fifty-five courses each semester and enrolls approximately 2,500 each year in its extension courses. This work is now directed from offices on East Ferry Street, while the classes are held in various buildings all the way from the Statler Hotel to Northern High School.

PALEONTOLOGICAL EXPEDITION OF THE NATIONAL GEOGRAPHIC SOCIETY AND THE SOUTH DAKOTA STATE SCHOOL OF MINES

Remains of protoceras, titanothere and other New World types of rhinoceros—will be sought in the West next summer by a joint paleontological expedition of the National Geographic Society and the South Dakota School of Mines. According to the announcement of the plans of the expedition made by Dr. Gilbert Grosvenor, president of the society, the field work will be carried on in the Badlands of western South Dakota, an eroded region which lies between the Cheyenne and the White Rivers, southeast of Rapid City. Dr. Joseph P. Connolly, president of the School of Mines, will be in charge of research. He will be assisted by James D. Bump, curator of the museum of the school.

It is estimated that the animals whose bones the expedition hopes to find lived in the Badlands area, then a grass-covered region of rolling plains, about thirty million years ago. Through changes not entirely clear to geologists, large quantities of eroded materials and volcanic ash from an unknown source were deposited on the old grassy plains, covering skeletons of some of the creatures that inhabited them.

Erosion during the last ten thousand years or more, while creating the deeply carved terrain of the Badlands, has exposed some of the buried bones and has disclosed the region to be a rich treasure house for science. Specimens of many types of vertebrate animals have been "mined" there during the last three quarters of a century. But among these only a few complete skeletons of titanothere, protoceras and rhinoceros have been recovered. The chief aim of the expedition will be to bridge this gap in scientific knowledge, but it is expected that the bones of other animals will be collected also.

The protoceras as reconstructed was remotely related to deer and antelope. The male, about the height of a sheep, had six horns or knobs on his head, one pair of them far down on his slender muzzle. Other unusual features were a pair of long slender tusks, rare among cud-chewing animals, front feet with four toes, and hind feet with only two. No member of the protoceras family has been discovered outside of North America.

The titanothere was a sort of elephantine rhinoceros, the largest being as much as nine feet high at the shoulder. Buried in the same beds of rock were much smaller rhinoceros-like creatures whose skeletons also will be sought by the expedition. Both these types of animals had relatives in the Old World.

The South Dakota Badlands were relatively inaccessible until a decade ago. Within the past few years some of the most scenic and picturesque portions of the eroded area have been set aside by the United States Government as the Badlands National Monument. Through this reservation excellent automobile roads have been built and over them scores of thousands of tourists pass each summer. During the year 1939 visitors numbered 205,100, the greatest number to visit any National Monument west of the Mississippi River.

THE INSTITUTE OF FOOD TECHNOLOGISTS

The first meeting of the Institute of Food Technologists will be held from June 17 to 19 at the Morrison Hotel, Chicago.

The program will consist of four three-hour sessions devoted to symposia on Food Engineering and on the Influence of Processing on Vitamin Content of Food supplemented by papers on food preservation, composition of foods, methods of analysis of foods and packaging of foods. The third day is to be given over to visiting of plants of the food manufacturing industry in Chicago. The chairman of the Program Committee is Dr. D. K. Tressler, New York State Agricultural Experiment Station, Geneva, N. Y. Plans for the meeting are being worked out by the newly organized Chicago Association of Food Technologists, of which Dr. E. H. Harvey, of Wilson and Company, is chairman of the Local Committee on Arrangements.

The institute was organized in Cambridge, Mass., last July at the close of the second conference on Food Technology, held under the auspices of the Massachusetts Institute of Technology. Its officers are:

President, Dr. S. C. Prescott, dean of science, Massachusetts Institute of Technology; *Vice-president,* Dr. Roy C. Newton, chief chemist of the Swift Company, Chicago; *Secretary-treasurer,* Dr. G. J. Hucker, New York State Agricultural Experiment Station, Geneva.

The membership of the institute includes chemists, bacteriologists, process engineers and others similarly trained or experienced in the manufacture, preservation and handling of food. Graduation from a college or a university with majors in at least two such sciences as chemistry, physics, biology, micro-biology and engineering in relation to food handling and processing is regarded as a desirable prerequisite for membership, but those having experience of at least three years in some type of technological work will be accepted, also distinguished students of food technology, whether or not they have had technical training, are eligible. Those who are active in special limited aspects of food technology and those scientifically trained for a career in the food industry are eligible for affiliate membership.

RECENT DEATHS

DR. FERDINAND ELLERMAN, who since 1905 had been associated with the Mount Wilson Observatory of the Carnegie Institution of Washington, from 1913 until his retirement in 1937 as astronomer, died in his seventy-first year on March 20.

DR. WILLIAM GIBSON SPILLER, emeritus professor of neurology at the School of Medicine of the University of Pennsylvania, died on March 19 in his seventy-seventh year.

DR. THOMAS DRYSDALE BUCHANAN, professor of anesthesia and director of the department of the New York Post-Graduate Medical School, Columbia University, died on March 21 at the age of sixty-four years.

SIR PATRICK PLAYFAIR LAIDLAW, deputy director of the British National Institute for Medical Research and head of its department of experimental pathology, died on March 20 at the age of fifty-eight years.

EDOUARD BRANLY, professor of physics in the Institut Catholique, Paris, died on March 24 at the age of ninety-five years. He was the discoverer of the principle of the coherer, one of the first successful devices used as a detector of wireless signals.

THE death at the age of seventy-six years is reported in *Nature* of J. H. Michell, professor of mathematics from 1923 to 1928 at the University of Melbourne, since 1938 honorary research professor of mathematics; and of E. Soler, emeritus professor of theoretical geodesy at the University of Padua, a vice-president of the International Association of Geodesy.

DR. MICHAL SIEDLECKI, professor of zoology, has died in the Sachsenhausen concentration camp. He was one of the hundred and sixty-four professors of Cracow University who were arrested and sent there at the beginning of November, 1939.

SCIENTIFIC NOTES AND NEWS

THE seventy-seventh annual meeting of the National Academy of Sciences will be held on April 22, 23 and 24, in Washington, under the presidency of Dr. Frank B. Jewett. The committee on arrangements is composed of Drs. Vannevar Bush, F. G. Cottrell, Frank B. Jewett, G. L. Streeter, Charles Thom, T. Wayland Vaughan and F. E. Wright, *chairman.*

THE annual general meeting of the American Philosophical Society will be held on April 18, 19 and 20, beginning at 10 A.M., on Thursday under the presidency of Roland S. Morris.

THE Catherine Wolfe Bruce Gold Medal of the Astronomical Society of the Pacific was presented to Dr. Frederick H. Seares, assistant director of Mount Wilson Observatory, at a meeting of the society on March 18. Dr. C. Donald Shane, professor of astrophysics in the University of California and president of the society, made the presentation.

THE prize of $1,000 in biological chemistry of the Eli Lilly and Company for 1940 has been awarded by the American Chemical Society to Dr. Eric Glendinning Ball, an associate of the Johns Hopkins School of Medicine, for chemical studies of certain biological substances, including the hormone adrenalin and vitamins B_2 and C. Dean Samuel Colville Lind, of the University of Minnesota, president of the society, will present the prize to Dr. Ball, a former Guggenheim fellow, at the opening session of the ninety-ninth meeting of the society in Cincinnati on April 8. Dr. Ball will present the paper for which the award was made, entitled "The Nature of the Enzyme, Xanthine Oxidase," as part of a Symposium on Vitamins and Nutrition to be held on April 10.

AT the recent Founders Day Convocation celebrating the sixtieth anniversary of the founding of the Case School of Applied Science at Cleveland, the doctorate of science was conferred on Dr. Philip M. Morse, professor of physics at the Massachusetts Institute of Technology. Wilbert J. Austin, president of the engineering and construction company bearing his name, was awarded the doctorate of engineering. Both Dr. Morse and Mr. Austin are graduates of the Case School.

A DINNER was given on March 2 in honor of Dr. A

K. Balls, principal chemist of the Food Research Division of the Bureau of Agricultural Chemistry and Engineering of the U. S. Department of Agriculture, by the Puerto Rico Chapter of Gamma Sigma Delta. Dr. Balls, who has been loaned to the Puerto Rico Experiment Station, has been working on vanilla enzymes during the present curing season. He spoke at the dinner on the general subject of enzymes.

DR. JEKUTHIEL GINSBURG, head of the department of mathematics of Yeshiva College, New York City, was the guest of honor on March 17 at a dinner held at the college in observance of his fiftieth birthday. Speakers at the dinner included Dr. Bernard Revel, president of the college; Dr. Cassius Jackson Keyser, professor emeritus of mathematics at Columbia University, and Dr. W. Pepperell Montague, professor of philosophy at Columbia.

DR. HOWARD S. FAWCETT, professor of plant pathology at the Citrus Experiment Station, Riverside, Calif., gave the annual Faculty Research Lecture of the University of California at Los Angeles on March 27. His lecture was entitled "Adventures in the Plant Disease World."

DR. PHILIP E. SMITH, professor of anatomy at Columbia University, was elected at the Louisville meeting president of the American Association of Anatomists.

THE following officers have been elected by the New York Branch of the Society of American Bacteriologists for the year 1940: *President,* Miss Mary McGrath, New York City Health Department; *Vice-president,* Dr. M. L. Isaacs, College of Physicians and Surgeons, Columbia University; *Secretary-treasurer,* Professor Edward J. Keegan, St. John's University.

DR. H. L. BLOMQUIST, of the department of botany of Duke University, and Wilbert Frye, of Pleasant Dale, W. Va., have been elected president and vice-president, respectively, of the Southern Appalachian Botanical Club for the coming year. Other officers, who serve four-year terms, are Dr. Rogers McVaugh, the National Arboretum, Washington, D. C., *secretary,* and Dr. Nelle Ammons, of the department of botany, West Virginia University, *treasurer.* The club publishes *Castanea,* a monthly semi-popular periodical, edited by Dr. Earl L. Core, of West Virginia University.

Nature states that Asa Binns, until recently chief engineer of the Port of London Authority, has been elected president of the British Institution of Mechanical Engineers.

H. W. STRALEY, III, Baylor University, Waco, Texas, has been appointed secretary of the Geophysical Education Committee of the Educational Division of the American Institute of Mining and Metallurgical Engineers.

DR. LOUIS MARTIN, director of the Pasteur Institute, Paris, has been elected president of the Paris Academy of Medicine to succeed General Sieur.

PROFESSOR J. HARLAND BILLINGS, of the Drexel Institute of Technology, Philadelphia, will represent the American Association for the Advancement of Science at the meeting of the American Academy of Political and Social Science, to be held in Philadelphia on April 12 and 13.

AT Columbia University Professor Leslie C. Dunn has been made head of the department of zoology, succeeding Professor Franz Schrader; Dr. William H. Woglom, associate professor of cancer research, has been named acting head of the Institute of Cancer Research in the place of Dr. Francis Carter Wood, now professor emeritus. Professor Albert T. Poffenberger has been reappointed head of the department of psychology. Professor Henry E. Garrett will be acting department executive, while Professor Poffenberger is on leave of absence.

DR. PETER I. WOLD, professor of physics and head of the department at Union College, has been made chairman of the division of science in succession to Dr. Edward Ellery.

DR. HAROLD M. FAIGENBAUM has been promoted to a full professorship in industrial chemistry at the Rensselaer Polytechnic Institute.

DR. KARL M. DALLENBACH, professor of psychology at Cornell University, will teach elementary psychology and conduct a seminar on attention, at the summer session of the University of California at Los Angeles. He has been invited to give an address on experimental psychology at the dedication of the new laboratory of psychology on June 19.

ELEVEN fellowships have been awarded by the American Association of University Women, four of which are in the sciences. Dr. Herta Leng, until the occupation of Austria by the Germans lecturer on physics at the Teachers College of the University of Vienna, who is working in the physical research laboratories of Purdue University, Lafayette, Ind., with the use of a cyclotron is studying the permeability of plant and animal cells; Dr. Elizabeth Lloyd White, of Norfolk, Va., an advanced student in embryology in the University of Pennsylvania, will continue research in zoological embryology; Dr. Donna Price, instructor in chemistry at Rockford, Ill., will work in the field of theoretical physical chemistry; Miss Margaret K. Deringer, research assistant in the department of embryology of the Carnegie Institution, will conduct experiments on hormone activity.

DR. VIRGIL P. W. SYDENSTRICKER, professor of medicine, University of Georgia School of Medicine, Augusta, has been awarded a grant of $6,000 by the Markle Foundation to continue his studies of pellagra.

DR. ARCHIBALD V. HILL, Foulerton professor and secretary of the Royal Society, London, who was recently elected member of Parliament to represent the University of Cambridge, arrived in New York on March 21. He plans to remain in the United States for about three months.

LEAVE of absence from the University of North Carolina has been granted from June to late September to Professor Harley H. Bartlett, chairman of the department of botany, to permit him to assist in a study at the Gorgas Memorial Hospital in Panama of the prevention of malaria.

PROFESSOR OSCAR D. VON ENGELN, professor of geology at Cornell University, is traveling through the southeastern states, where he is visiting and photographing sites of geomorphic interest.

DR. WOJCIECH SWIETOSLAWSKI has arrived from Poland as visiting professor in the University of Pittsburgh. He is chairman of the Committee on Physico-Chemical Standards of the International Union of Chemistry and one of its vice-presidents. Until the closing of the University of Warsaw, he had been professor of physical chemistry and director of the Physico-Chemical Institute. After an introductory lecture on March 25 he will give on Monday of each week, for seven weeks, illustrated lectures on ebulliometry. During the summer session he will give a series of twenty lectures on ebulliometry and calorimetry, beginning on July 2 and ending on July 23.

THE Gehrmann Lectures for 1939–1940 will be delivered in the Medical and Dental College Laboratories Building of the College of Medicine in Chicago of the University of Illinois on April 17, 18 and 19, by Dr. C. A. Elvehjem, of the department of biochemistry of the College of Agriculture of the University of Wisconsin. The titles of the separate lectures are "Vitamins and Deficiency Diseases," "Methods of Determining Vitamin Deficiencies," "Vitamins and Normal Nutrition."

A DINNER will be given on April 10 at the Mayflower Hotel, Washington, in celebration of the sesquicentennial of the signing of the United States Patent Law. A Parade of Inventions, being arranged in the Department of Commerce Auditorium from 1:30 to 4:30 P.M. for guests of the sesquicentennial, will, through the medium of dynamic exhibits, tell the story of one hundred and fifty years of industrial progress achieved under the protection of the Patent Law. Under Secretary of Commerce Edward J. Noble and Commissioner of Patents Conway P. Coe have accepted invitations to speak on the "Parade of Industries" program, a portion of which is to be broadcast over the Blue Network of the National Broadcasting Company from 10:00 to 10:30 P.M. on Wednesday, April 10. In addition many interesting features especially appropriate to the celebration of the signing by President George Washington of the Patent Law have been arranged.

THE spring meeting of the Electrochemical Society will meet at Wernersville, Pa., on April 24, 25, 26 and 27. There will be three scientific-technical sessions, one devoted to electric steel, another to progress in electrodeposition and a third to papers on miscellaneous electrochemical topics. The local committee, headed by Dr. A. Kenneth Graham, has arranged for visits to electric steel and other plants at Reading and vicinity and a visit will be made to the town of Hershey, for which many large public buildings have been provided by Milton S. Hershey.

THE sixteenth National Shade Tree Conference will be held in Detroit from August 27 to 30. Headquarters will be at the Book-Cadillac Hotel. In addition to the program of discussions on technical and scientific problems by scientific men, trade and educational exhibits, as well as field demonstrations, will be held.

PHI SIGMA Biological Society celebrated its silver anniversary on March 15. The society was established at the Ohio State University in 1915. There are now thirty active chapters and well over 10,000 members. Scholarship medals are awarded each year in biology wherever a chapter is located. The official quarterly publication, *The Biologist,* has now reached its twenty-first volume.

THE 297th meeting of the Washington Academy of Sciences on March 21 was devoted to the presentation by the academy of its first awards for scientific achievement. Certificates of award were presented as follows: *Biological Sciences:* Herbert Friedmann, U. S. National Museum, in recognition of his researches and publications in ornithology. *Engineering Sciences:* Paul A. Smith, U. S. Coast and Geodetic Survey, in recognition of his contributions to our knowledge of the ocean bottom along the eastern coast of the United States. *Physical Sciences:* Wilmot H. Bradley, U. S. Geological Survey, in recognition of his contributions on the oil shale of the Green River formation of Wyoming. Alexander Wetmore, assistant secretary of the Smithsonian Institution; Leo Otis Colbert, director of the U. S. Coast and Geodetic Survey, and Gerald F. Loughlin, chief geologist of the U. S. Geological Survey, respectively, introduced the recipients of the awards, who gave brief addresses concerning their work.

DISCUSSION

VARIETIES OF TRITICUM VULGARE PRACTICALLY IMMUNE IN ALL STAGES OF GROWTH TO STEM RUST[1]

In searching for wheats of value for breeding purposes one of the aims has been to secure a variety of *Triticum vulgare* with immunity at all stages of growth to all physiologic races of *Puccinia graminis Tritici.* Of the various varieties tested at the Dominion Rust Research Laboratory, at Winnipeg, six appear to meet these requirements.

Five of the wheats in question were received in 1934, from the Department of Agriculture at Nairobi, Kenya Colony, under the identifying numbers 122.D.I.T.(L), 117.E.16.B.1, 117.B.5.B.2, 117.K.16.A.(L) and 117.1.5.-F.(L). They were developed by Burton and his associates and have been described by Burton[2] as being rust-resistant. Macindoe[3,4] tested a number of Kenya wheats, and found the best of these to be either entirely immune or very resistant to stem rust under epidemic conditions in Australia.

The sixth variety was received, in 1935, from Mr. M. S. J. McMurachy, a farmer near Strathclair, Manitoba, Canada. Mr. McMurachy had discovered it about the year 1930 as a single rust-free plant in a field of Garnet wheat. He increased it, and when he found that it withstood the rust epidemic of 1935 he brought it to the attention of the staff of the Dominion Rust Research Laboratory. This variety is now known as McMurachy's Selection.

Every year, since these wheats were received, they have been subjected, at Winnipeg, to an artificially-induced epidemic of stem rust in which approximately 30 physiologic races collected in various parts of Canada were used as inoculum. In addition the plants were, of course, also exposed to any natural rust infestation that occurred. Apart from an occasional trace of rust, which will be discussed below, the six wheats in question appeared to be immune to all races occurring in the field.

The same varieties were tested in the seedling stage in the greenhouse with the following twenty physiologic races of stem rust: 9, 10, 11, 15, 17, 19, 21, 29, 32, 34, 36, 38, 39, 48, 50, 56, 113, 120, 139 and 162. The seedlings of all six varieties reacted alike. Except at abnormally high temperature where resistance was found to break down, no rust pustules were produced by any of the twenty above-mentioned races, but minute flecks scarcely visible to the naked eye were occasionally observed. In this connection it may be mentioned that according to Macindoe[3] some of the Kenya wheats have been found by Waterhouse to possess resistance in the seedling stage to the prevalent Australian races of stem rust.

It has been found that plants of the Kenya wheats and of McMurachy's Selection may be infected with stem rust by injecting urediospores within the leaf sheath where they come into contact with and infect the immature and as yet unexposed parts of the stem. As the stem grows the infected part emerges from the leaf sheath and the rust pustules become visible. Such infections may, however, be produced on most wheat varieties that show immunity under field conditions, and have even been produced on certain oat varieties injected with wheat stem rust, an organism to which they are immune in the field.[5] The rare stem-rust pustules that have been observed on plants of the Kenya wheats and McMurachy's Selection in the field have almost invariably been situated on the stem just above the leaf sheath, which suggests that they are due to spores falling within the leaf sheath and causing internal infections.

From the results obtained in the various rust tests there seems to be good reason to believe that the six wheat varieties in question are practically immune at all stages of growth to all physiologic races of stem rust occurring in Canada.

R. F. Peterson
T. Johnson
Margaret Newton
Dominion Rust Research Laboratory,
Winnipeg, Man.

[1] Issued as Contribution No. 109 of the Cereal Division, Experimental Farms Service, Dominion Dept. of Agriculture, Canada.

[2] G. J. L. Burton, Ann. Rept. Dept. of Agric. Kenya for the year ended December 31, 1931. Pp. 176–201, 1932.

[3] S. L. Macindoe, *Agr. Gaz. N. S. W.* 42: 475–484, 1931.

[4] Ibid., *Jour. Austral. Inst. Agric. Sci.*, 3: 25–31, 1937.

[5] Margaret Newton and A. M. Brown, *Can. Jour. Research*, 11: 564–581, 1934.

FRESH-WATER JELLYFISH IN HAWAII

The wide distribution of fresh-water jellyfish in the United States was emphasized by the report of Dr. Waldo L. Schmitt[1] early this year. Locality records now include at least twenty states in addition to the Canal Zone. More recently H. Z. Gaw and L. H. Kung[2] announced the finding of fresh-water jellyfish in Kiating, Szechuen, China.

The islands of the Central Pacific area should now be included in the range of fresh-water coelenterates by reason of their discovery on the island of Maui. As reported by Miss Miriam Sylvester, of Hamakuapoko, Maui, medusae were first observed during November, 1938, in a pond in Maliko Gulch, about eight

[1] *The American Naturalist*, 73: 83–89, January–February, 1939.

[2] Science, 90: 299, September 29, 1939.

miles from the sea at an elevation of between 1,500 and 2,000 feet. After winter rains set in the medusae disappeared but were again observed in the same pond in May, 1939; they were still present in September of this year, but disappeared about the middle of October.

Some specimens were sent to me for determination. The likeness of the Maui medusa to *Craspedacusta sowerbii* was at once suggested and later verified by comparison with specimens of that species received through the kindness of Dr. A. E. Woodhead, of Ann Arbor, Mich. The only apparent difference between the Michigan and Hawaiian specimens is a larger number of tentacles in the latter. This, however, is probably a difference in size of individuals. Maui specimens 17 mm in diameter of bell bear approximately 500 tentacles, arranged in several series, varying in length and in level of separation from the surface of the bell.

Difficulty is expressed by Miss Sylvester in keeping the medusae alive under laboratory conditions. In tap water they lived only a day and but four or five days when pond water was used.

C. H. EDMONDSON
UNIVERSITY OF HAWAII

REAPPEARANCE OF AN ANCIENT ABSURDITY REGARDING MAGNETS

IN the *Science News Letter* for February 3, 1940, there appears in a prominent position[1] a story which reverts to a way of comparing magnets that became obsolete two hundred and ten years ago. The anonymous author of this story is only the latest of a long line of careless writers who make it hard to justify the popularization of science by its uncritical friends.

The mistake, repeated five times in a total of less than 150 words, consists in setting as a figure of merit for a magnet the ratio of the weight it can lift to its own weight. This was outmoded in 1730, when James Hamilton (Lord Paisley) put the facts in this connection into the following statement:[2]

> The principle upon which these tables are formed is this: That if two loadstones are perfectly homogeneous, that is if their matter be of the same specific parity, and of the same virtue in all parts of one stone, as in the other; and that like parts of their surfaces are cap'd or arm'd with iron; then the weights they sustain will be as the squares of the cube roots of the weights of the loadstones; that is, as their surfaces.

Hamilton's rule teaches that any ratio of weight lifted to weight of lifting magnet can be reached with any magnet material simply by making the magnet small enough, and this interpretation was very well and widely known fifty years ago.[3] It therefore is complete nonsense to say that one material or method of construction is superior to another because a certain little magnet of the newer sort can lift a more impressive multiple of its own weight than can some indefinitely larger magnet of the older sort.

This note is not intended to deny that new materials and new methods of using them have vastly increased the usefulness of permanent magnets wherever magnetic adhesion is wanted. All that is objected to is the fallacy of emphasizing weight ratios in this connection.

Those who should have known better, but didn't, may derive cold comfort from the fact that this particular absurdity has been repeated at frequent intervals ever since 1730, sometimes by reputable physicists, and even after Hamilton's rule had been rediscovered twice.[4] All but the simplest truths about static electricity and permanent magnets seem, indeed, to have been forgotten very generally during the century, 1820–1920, in which electromagnetic phenomena were so much more novel and interesting.

L. W. MCKEEHAN
SLOANE PHYSICS LABORATORY,
YALE UNIVERSITY

Since the photograph caption to which Professor McKeehan refers was based on information supplied by the General Electric Company, when the editor of SCIENCE gave opportunity for adding an explanation to Professor McKeehan's comment, we referred the matter to that company with the result that the following explanation by Mr. W. E. Ruder, head of the metallurgical section of the General Electric Research Laboratory, was received with permission to quote:

> Professor McKeehan's note to SCIENCE borders on the redundant. No comparison or rating of *magnets* is made or intended. In the "500X", "1500X" and "4500X" holding powers mentioned the same magnet material, Alnico, of essentially the same size was used. The whole point to these experiments is to bring out the fact that the design of a magnet is of the utmost importance in its application. With the newer types of higher coercive force and lower residual magnet alloys it is most important to reduce leakage to a minimum if the maximum available energy of the magnet is to be utilized in *holding*. In this case we reduced leakage to a minimum with soft iron pole pieces and introduced multiple gaps so designed as to take the greatest advantage of the high coercive

[1] The upper right-hand corner of the page facing the front cover, or, more precisely: Vol. 37, p. 67.

[2] Royal Society of London, *Phil. Trans.*, 36: 245–250, 1730.

[3] For example, it was discussed at length by Silvanus P. Thompson in the second of his Cantor Lectures on the electromagnet, delivered in London on January 27, 1890: *Journal of the Society of Arts*, 38: 889–905, 909–926, 1890, especially pp. 895–896.

[4] First by Daniel Bernoulli: *Acta helvetica, physico-mathematico-botanico-medica*, 3: 233–249, 1758; again by P. W. Haecker: *Annalen der Physik . . . Poggendorff*, 57: 321–345, 1842.

force of the magnet material used. We made no attempt to reestablish or disprove the Hamilton Rule as quoted by Professor McKeehan, as it has no bearing whatever on this magnet design. If we cared to be critical, we would ourselves object to the "160 man—72,000 pound weight" statement, as lifting and holding are obviously not the same thing.

We have no objection to Professor McKeehan's academic statements as such, but to title them as he has, or to refer to our design of magnet assembly in that connection implies a lack of fundamental knowledge on our part that is hardly justified. With the interested lay reader the terms coercive force, residual, and maximum available energy may be assumed to have little concrete meaning, but to say that a magnet of a certain size and design will hold 100 pounds conveys something quite real even though only comparative. It was never intended as an absolute measure of magnetic quality.

WATSON DAVIS

SCIENCE SERVICE
WASHINGTON, D. C.

ROGER BACON WAS MISTAKEN

IN a recently published, and in general commendable, book I find the following:

> These ancient volumes said that hot water would freeze more quickly than cold water; . . . These are just samples of some of the drivel that was accepted by "learned" men. . . . But Bacon had little regard for authority. He was an experimenter. So he took two vessels exactly alike and filled one with cold water and one with hot. It was a bitter cold day. He set the vessels out of doors. When the cold water froze first Bacon decided that the ancient author was a liar.

But if Bacon had taken a pint of drinking water from his kitchen and a pint of boiling water from his teakettle, had put each pint in similar open tin dishes, and had set them outdoors in zero weather he would have found that the hot water was the first to freeze. The hot water would have cooled very rapidly, partly on account of the rapid evaporation and partly on account of the rapid loss of heat by radiation. The cold water would have evaporated slowly and cooled slowly. Consequently, the hot water would have reached the temperature of the cold water several degrees above the freezing point, and, since a large amount had evaporated, the smaller of the two masses of water was the first to freeze.

Those despised ancients knew a thing or two.

JOSEPH O. THOMPSON

AMHERST COLLEGE

SCIENTIFIC BOOKS

POLITICAL GEOGRAPHY

The Earth and the State, A Study in Political Geography. By DERWENT WHITTLESEY. xvii + 618 pp. New York: Henry Holt and Company, 1939. $3.75.

GEOGRAPHERS investigate the characteristics that differentiate areas of the earth, whereas historians deal with the differentiation of periods in the time sequence of human events. Space and time, whether in physics or in the study of man, can not in the final synthesis be separated; but because of the widely different techniques, geography and history have developed as separate disciplines. Inevitably they must remain distinct; yet all the more is it essential that scholars in both these fields constantly attempt to reunite them in practice.

Professor Whittlesey's book on political geography is highly successful in maintaining its essentially geographic objectives while making use of historical balance. The book deals with the processes and characteristics which differentiate political areas; and these are traced over a sufficient background of history to provide an adequate interpretation of present conditions.

This new geographical approach to the study of political areas endows such areas with new meaning. The territory of every state or nation includes organic parts that are characteristic of all states. Each state, for example, may be differentiated into such parts as a nuclear core, constituent or administrative regions, problem areas, vulnerable zones, capitals, strategic spots and boundaries.

Professor Whittlesey's discussion of the inherent differentiation of political areas is far from academic. In the chapters on certain specific modern states, an important and readable contribution has been made to an understanding of the problems which trouble the present-day world. New light is thrown on the chaos of Europe—on the relations of Great Britain, France, Germany, Italy and other political units whose struggles are affecting the whole world. It is imperative that the free citizens of our own country should attempt to understand and formulate a policy regarding conditions in Europe, and to this end Professor Whittlesey's book makes a notable contribution.

The thesis is presented that the success, perhaps even the chance for survival, of a state is affected by the pattern of arrangement of the various parts of the political area and of the relations of these parts to the underlying qualities of the land. That the territory which is now Italy has been unified in one state only for 70 years in the modern period, and only for 500 years under Roman rule, whereas this territory was subdivided during the rest of the 2,500 years of Italian history, suggests, "a serious weakness of geopolitical structure not apparent from the map." Pro-

fessor Whittlesey's analysis of the Italian state presents an important interpretation of this weakness which is not solely a poverty of agricultural land and mineral resources.

Of the eighteen chapters in the book, six are devoted to Europe. The process of the formation of the nation-states is illustrated by a discussion of Great Britain, France and Germany. The chaotic mid-Danube is presented through an interpretation of the capitals. The conflict of interests in the Mediterranean Basin is set forth as a background for the treatment of Italy. The strong unitary tradition of France is interpreted in terms of the interaction of land and people, as the various constituent parts of the country were one by one attached to the nuclear core. If some scholars find fault with the actual extent of territory included in the Ile de France, this need not detract seriously from the strength of the argument regarding the origin of this strongly coherent state. In contrast stands Germany. "Confusing disintegration paralleled by surprising unification" is the phrase used to describe the process of state formation on the other side of the Rhine, in a land "which is made up of a crude gridiron of lines of travel, and in which neither boundaries nor internal environment set a decisive mold for plastic statecraft." The essential contrast between western industrial Germany and eastern feudal Germany throws light on the problems which that state must face in its struggle to remain coherent.

One chapter is devoted to Africa and five to the Americas. Here the essential contrast in the process of state formation becomes apparent between the accretion of areas around a central nucleus, and the expansion of colonies from a primary settlement center. In Great Britain, France or Germany the people of the nuclear core for one reason or another were able to conquer and attach to the original political area the people of bordering areas. This, indeed, was the process by which such great Indian states as the Empire of the Incas was formed. But it is not the process by which the modern states of the Americas were developed. The nuclear core of colonial states has a geopolitical function which differs profoundly from that of, let us say, France. Even where the native people remain in considerable numbers, as in Peru or Mexico, they are scarcely incorporated in the colonial states, as the people of the various parts of France were brought into the coherent French state. From primary centers of settlement, other colonies are sent out, producing, after a time, a pattern composed of clusters of population surrounded by areas of scantily occupied land. When states were formed, not by a slow process but suddenly by revolt from the mother country, the boundaries were commonly drawn through the thinly populated areas between the nuclear cores. Compared with Europe, the structure of such states is relatively simple. The process, however, is so different that some question might be raised concerning the advisability of applying the same terms to both.

Among the other chapters in Professor Whittlesey's book, two are of outstanding importance and interest. One discusses the political geography of colonies as related to highly localized commercial production. Three products, rubber, sugar and wheat, are treated. The historical geography of sugar, from the fabulous days of the Portuguese planters on the coast of northeastern Brazil, through the scramble for sugar colonies in the West Indies, to the rise of modern Cuba and Java is set forth with a coherence which places this section of the book, in the reviewer's opinion, foremost among the brief treatments of this subject. Impressive, also, is the treatment of the modern importance of the oceans in relation to routes of communication and colonial expansion.

These chapters will be of interest to non-professional readers as well as to students of political geography, for they present in admirable form the contribution of this branch of geography to the problems of the modern world. The book will also be of considerable importance as a step forward in the formulation of both content and theory in the newly developing field of political geography. The importance of the interpretations and the logic of the view-point need not be obscured by such unfortunate blemishes as are produced by the failure of a draughtsman to learn well the place geography of South America. No more important book in the field of geography has appeared in recent years.

Preston E. James

University of Michigan

NATURALISTS IN SOUTH AMERICA

The Great Naturalists Explore South America. By Paul R. Cutright. xii + 340 pp.; 42 full-page illustrations; bibliography and index. New York: The Macmillan Company. $3.50.

This book, by a professional zoologist with experience in the tropics, will be read with intense interest by the general reader and by the many zoologists who still have an interest in the habits of animals as well as in their morphology, physiology, etc.

From the title it might have been expected that rather more space would have been devoted to the experiences of the "great naturalists"—from Humboldt, Wallace and Darwin to those still living; but Part II is so thoroughly readable that one would not have any of it omitted.

About a dozen of the typical South American mammals, such as the vampire, the tapir and the manatee, are described and sometimes figured with excellent photographs.

Half a dozen birds are described in the same way, and then the Crocodilians and serpents are discussed.

Of the fishes the dreaded piranha, the sting-ray and the electric eel are made more real to most of us, who have spent, at most, only a few months in the South American jungle, than they ever were before.

The descriptions end with certain jungle pests and insects for which the continent is noted.

A six-page bibilography and an index add to the usefulness of the book.

ALBERT M. REESE

WEST VIRGINIA UNIVERSITY

REPORTS

THE NEW INTERNATIONAL COMMISSION OF SNOW AND GLACIERS

AT the Seventh Assembly of the International Union of Geodesy and Geophysics, which was held in Washington last September, the International Association of Scientific Hydrology, one of the component units of the Union, effected the consolidation of two of its own commissions—the Commission of Snow and the Commission of Glaciers. The action was taken after a preliminary poll of the membership of the two commissions had shown an overwhelming majority in favor of the consolidation. Moreover, the presidents of the two commissions, Professor J. E. Church, of the University of Nevada (Snow), and Professor J. M. Wordie, of St. Johns College, Cambridge, England (Glaciers), had strongly recommended it.

Professor Church was designated acting president of the new Commission of Snow and Glaciers, to serve in that capacity until international relations will permit the holding of a formal election of officers. Like all other sections of the International Union of Geodesy and Geophysics the Association of Hydrology has deferred election of officers for the present triennial, in view of the sparse attendance of European delegates at the Washington Assembly, due to war conditions.

The new Commission of Snow and Glaciers aims to take into its purview all research relating to snow and ice in their varied forms. It might appropriately have been named Commission of Snow and Ice, but it preferred to adopt the name Commission of Snow and Glaciers in deference to the former Commission of Glaciers, which is by far the older of the two bodies that are now consolidated, and which, indeed, was in existence long before the Association of Hydrology was formed.

The original *Commission Internationale des Glaciers* had its inception in 1894, at the International Geological Congress at Zurich. It was charged, broadly, with the task of studying existing glaciers throughout the world, but actually its efforts have been concentrated on securing statistics of the secular variations—advance and recession—of glaciers in response to climatic fluctuations. Inasmuch as this task requires the making of annual measurements on large numbers of glaciers in different countries, with the aid of many co-operating agencies, governmental, scientific and other, it has inevitably grown into a vast enterprise. The results, however, have proved of value, not only to glaciologists but also to hydrologists, hydraulic engineers (making use of runoff from glaciers for economic purposes) and climatologists.

In 1914 the work of the commission was stopped by the World War, and coordinated effort ceased for a number of years. In 1927, however, at the invitation of the International Association of Scientific Hydrology, the commission transferred its functions and its personnel to a new *Commission Glaciologique* (Commission of Glaciers) created by the association, and under these new auspices its work has been carried on ever since.

Meanwhile, at the Lisbon Assembly, in 1933, the association set up a Commission of Snow and appointed Professor Church president thereof. So rapidly did this commission grow under the enthusiastic leadership of its president that by 1936, when the association met in Edinburgh, it had become by far the largest and most active of all the commissions of the association and had expanded its field to cover all phenomena of snow and ice, with the exception of glacier-variations. Overlap with the work of the Commission of Glaciers seemed almost inevitable, and so the question naturally arose whether consolidation of the two commissions would not in the end be mutually advantageous to them. Their union was approved by the executive committee of the association at its meeting in April, 1939, at Montreux, Switzerland, and so the way was paved for its final consummation at the Washington Assembly.

Provision has been made within the new Commission of Snow and Glaciers for a permanent Committee on Glacier-Measurements, which will continue the work previously carried on by the Commission of Glaciers, securing systematic records of the annual variations of glaciers. It is Professor Church's intention to expand the scope of that work, which heretofore was restricted largely to Europe and the United States, so as to take in all the more important glacier-districts of the world, including the Andes of South America, the great mountain chains of Asia, the Alps of New Zealand and the Arctic regions.

Aside from this enterprise the commission has

planned for the triennial ending in 1942 the following formal program:

Question 1. Study of the origin, drift and dissolution of icebergs, with reference to the forecasting of their seasonal appearance.

Question 2. Physical changes in the snow-cover conducive to runoff, especially floods.

Question 3. Study of the crystalline texture of glacier-ice in relation to the mode of movement of glaciers.

In addition the following four special projects have been assigned to temporary committees:

(1) Standardization of maps of snow-cover and ice-cover for the world.

(2) Uniform classification of different types of snow and snow-cover, and uniform nomenclature for the same.

(3) A system of classification for the international bibliography of snow and ice.

(4) Standardization of methods of snow-surveying and forecasting runoff from snow.

Incidentally, it may not be out of place here to explain for the benefit of those who may wonder why the International Association of Scientific Hydrology insists on keeping the adjective "scientific" in its title, that many of the European members consider it desirable to keep it in order to emphasize the fact that the association is concerned solely with research in hydrologic science, excluding the practical application thereof in the domain of hydraulic engineering.

FRANÇOIS E. MATTHES,
Assistant Secretary, International Association of Scientific Hydrology
U. S. GEOLOGICAL SURVEY,
WASHINGTON, D. C.

SPECIAL ARTICLES

MOBILIZATION OF VITAMIN A FROM ITS STORES IN THE TISSUES BY ETHYL ALCOHOL

ONE of the problems under investigation in this laboratory is the mobilization of vitamin A from its stores in the body. Previous to the experiments with ethyl alcohol reported here, the effects of various drugs and experimental procedures, including the action of adrenalin, histamine, insulin, mecholyl chloride, chloroform, exsanguination, ether inhalations and operative trauma, were tried. Repeated bleeding of rabbits gave some evidence of vitamin A mobilization for, although considerable amounts of blood were withdrawn, the total quantity of vitamin A in the circulating blood remained constant. Prolonged ether anesthesia at times produced a slight rise in the serum vitamin A but this was not a constant finding. However, no agent, in our hands, has yet produced an effect comparable to that of ethyl alcohol. In these experiments the vitamin A content of the serum was determined according to the technic of Evelyn, using the Evelyn Photoelectric Colorimeter.

Two normal dogs were given 60 ml of ethyl alcohol in a 20 per cent. aqueous solution by stomach tube. The dogs had not eaten for twenty-four hours. The vitamin A content of the serum of both dogs showed a prompt increase, with maxima occurring at seven and twenty-four hours respectively after the adminis-

TABLE I

THE VITAMIN A CONTENT OF SERUM IN NORMAL DOGS FOLLOWING THE ADMINISTRATION OF ETHYL ALCOHOL

No. of dog	Ethyl alcohol Ml	Wt. of dog Kg	Time of fasting Hrs.	Evelyn photoelectric units of vitamin A per 100 Ml of serum						
				time after the administration of ethyl alcohol						
				Fasting	1½ hrs.	3 hrs.	6 hrs.	9 hrs.	24 hrs.	48 hrs.
1	60 By stomach tube	18	24	222	309	440	763	...	638	...
2	60 By stomach tube (Dog vomited)	24	24	263	358	389	385	412	440	362
3*	60 By stomach tube	17	48	89	120	142	...	154	192	150
4†	60 By stomach tube	18	48	203	319	389	453	498	669	849
5	60 By stomach tube	17	48	483	630	699	...	728	621	538
6	60 By stomach tube	17	48	569	1,323	...	805	914	659	...
7	30 By stomach tube	16	48	43	77	103	...	125	127	129
8	15 By stomach tube	18	48	320	424	459	...	471	385	...
9	17.5 Intravenously	21	20	424	518	571	662	600	742	488
10‡	16 By portal vein	17	44	150	249	292	...	...	...	...

* Liver contained 1,926 Evelyn Photoelectric Units of vitamin A per 100 grams of tissue.
† Liver contained 50,463 " " " " " " " " " " "
‡ Liver contained 2,747 " " " " " " " " " " "

ration of the alcohol. To rule out the possible effect of increased absorption of vitamin A which might possibly have been present in the gastro-intestinal tract, the experiment was repeated with six normal dogs that had been fasted for forty-eight hours. These dogs received amounts of ethyl alcohol varying between 15 ml and 60 ml in a 20 per cent. aqueous solution by stomach tube. An increase in the vitamin A content of the serum was observed in all cases as is shown in Table I. In two of the dogs with fistulas of the thoracic duct, the vitamin A content of the lymph was determined and no increase proportionate to the increase in the blood was noted.

To rule out further the possible effect of absorption of vitamin A from the gastro-intestinal tract, one dog was given ethyl alcohol in Ringer's solution intravenously. A rise in the vitamin A content of the serum followed, similar to that observed in the dogs already mentioned. In another dog, ethyl alcohol injected directly into the portal vein produced a marked rise in the vitamin A content of the hepatic vein. This observation suggests a direct effect of the alcohol on the liver. However, another possibility which should be considered is this: Ethyl alcohol may injure the epithelium of the gastro-intestinal tract or the other tissues. The injured tissue may produce a substance X, which enters the blood, passes to the liver or other vitamin A stores and liberates the vitamin.

In three of the dogs a biopsy of the liver was performed and there seemed to be a positive correlation between the increase of vitamin A in the serum after the administration of the alcohol and the concentration of vitamin A originally present in the liver. It is hoped that this correlation may lead to the development of methods for the study of the vitamin A reserves in the body. If further observations confirm a direct action of ethyl alcohol on the liver, this fact may possibly aid in the study of liver function. Further work in this direction is now in progress in this laboratory.

It is also planned to study the effect of alcohols of the homologous series, methyl, ethyl, propyl, butyl and higher alcohols such as cetyl and aldehydes, acids, acetates, lactates, phosphates, etc., to determine whether they have the capacity for mobilizing vitamin A.

SAMUEL W. CLAUSEN
WILLIAM S. BAUM
AUGUSTA B. MCCOORD
JOHN O. RYDEEN
BURTIS B. BREESE

DEPARTMENT OF PEDIATRICS,
SCHOOL OF MEDICINE AND DENTISTRY
OF THE UNIVERSITY OF ROCHESTER

THE ISOLATION OF PHYTIN FROM SOIL[1]

THE general behavior of soil organic phosphorus in extraction and fractionation is explainable on the basis that phytin is present in soil. However, the presence of phytin in soil has not heretofore been demonstrated. It has been shown[2] that phytin, added to silica sand cultures, is readily attacked by soil microorganisms. This led to the conclusion that phytin could not accumulate in soil.

We have found that, when phytin was added to soil cultures, it did not readily decompose, but behaved in a manner similar to our so-called soil "nucleic acid" preparations.[3] Moreover, analyses of soil "nucleic acid" showed the ratio of nitrogen to phosphorus to be very much lower than would be expected from such material. A large proportion of the soil organic phosphorus is stable to alkaline hydrolysis and also comparatively resistant to acid hydrolysis.[3] We have found also that organic phosphorus may be precipitated from an acid hydrolysate of soil by ferric chloride, and that part of the phosphorus of the soil "nucleic acid" is precipitable by ferric chloride in acid solution. These facts strongly indicate the presence of phytin in soil.

The material precipitated by ferric chloride from soil "nucleic acid" preparations was obviously not a pure substance. Oxidation with alkaline hypobromite destroys most of the organic matter of soil extracts, but does not liberate phosphate from a major part of the soil organic phosphorus, as was shown by Dean.[4] Investigation showed that phytin is quite stable to alkaline hypobromite. By means of this treatment of an alkaline soil extract, coupled with ferric chloride precipitation, we have been able to prepare a small quantity (about 1.25 g) of a faintly yellow-colored product which contained about 25 per cent. of the organic phosphorus of the original soil. Similar material was obtained from a soil "nucleic acid" preparation.

The phosphorus : iron ratios of the preparations are given in Table I along with corresponding data for ferric phytate prepared from wheat-bran phytin. All the ferric salts were precipitated from acid solution by an excess of ferric chloride. Solutions of the sodium salts were obtained by decomposing the ferric salts with sodium hydroxide. Phosphorus : iron ratios were also determined by acidifying these solutions to 0.6 per cent. hydrochloric acid and titrating with ferric chloride to the thiocyanate end-point. The ratios determined by titration are in agreement with those reported by Rather.[5] It is noteworthy that phytin combines with much more iron than is indicated by titration to the thiocyanate end-point.

---

1 This work was financed in part through a grant from the National Research Council, Ottawa, Canada.

2 J. T. Auten, *Soil Science*, 16: 281–294, 1923.

3 C. L. Wrenshall, W. J. Dyer and G. R. Smith, *Sci. Agr.*, 20: 266–271, 1940.

4 L. A. Dean, *Jour. Agr. Sci.*, 28: 234–246, 1938.

TABLE I

THE P : Fe RATIOS OF SOIL AND BRAN PREPARATIONS

Material examined	Phosphorus : iron ratio	
	By analysis of the Fe salt	By $FeCl_3$ titration of the Na salt
Soil preparation (1)	0.76	{ 1.27 1.19
Soil preparation (2) (two bromine treatments) ..	0.69	
Bran preparation (1)	0.71	1.12
Bran preparation (2)	0.67	1.20
Bran preparation (3) (bromine treated)	0.68	

A solution of the sodium salt of the soil preparations gave the Fischler and Kurten[6] test for phytin. The same solution was subjected to the action of phosphatase (intestinal mucosa extract) and of phytase (bran extract) with the results shown in Table II.

TABLE II

DEPHOSPHORYLATION BY INTESTINAL AND BRAN EXTRACTS (RESULTS EXPRESSED AS PERCENTAGE OF THE TOTAL ORGANIC P)

Substrate	Intestinal extract (pH 8.5)			Bran extract (pH 4.8)	
	Days incubated at 37° C.			Days incubated at 37° C.	
	3	6	10	3	7
Nucleic acid	52.4	70.5	75.0	72.2	72.2
Na salt of soil preparation	9.0	19.6	27.0	70.5	89.4
Na phytate (bran) ..	0.0	1.4	5.6	81.5	85.3
Na phytate, bromine treated (bran) ..				83.0	95.1
Fe phytate, bromine treated (bran) ..				0.0	2.7

Intestinal extract has very little action on phytin, while bran extract vigorously attacks both phytin and nucleic acid but has no appreciable action upon ferric phytate.

The data in Tables I and II would appear to confirm the identity of the soil preparation as ferric phytate.

We have now obtained indications that phytin is promptly fixed in acid soils, presumably by combining with iron. This would help to explain the accumulation and the low availability to plants of the organic phosphorus in Quebec podsol soils, since ferric phytate apparently is resistant to attack by enzymes, probably because of its low solubility.

A detailed account of these experiments will be published elsewhere at an early date.

W. J. DYER
C. L. WRENSHALL
G. R. SMITH

CHEMISTRY DEPARTMENT,
MACDONALD COLLEGE,
QUEBEC

[5] J. B. Rather, *Ark. Agr. Exp. Sta. Bul.* 135, 1917.

[6] F. Fischler and F. H. Kurten, *Biochem. Zeit.*, 254: 138–147, 1932.

ON THE NATURE OF THE LEUKOCYTOSIS-PROMOTING FACTOR OF INFLAMMATORY EXUDATES[1]

IN earlier studies the writer has shown that there exists in inflammatory exudates of animals a leukocytosis-promoting factor (abbreviated as the LPF), capable *per se,* when injected into the circulating blood of normal dogs, of inducing a marked rise in the number of white cells.[2,3] The presence of this factor offers an explanation for the mechanism of leukocytosis frequently accompanying inflammatory processes. The active principle is essentially indiffusible and thermolabile.[2,3] Heating the exudate to 60° C. inactivates its leukocytosis-promoting property. These facts are compatible with the possibility that the LPF is a protein. This original view has now been further verified. The present observations indicate that the factor is either a globulin or that it is at least closely associated with that class of proteins. The details of all the observations will be reported *in extenso* elsewhere. The essential facts, however, can be briefly summarized as follows:

The normal range of variation in white blood cell counts of several dogs over a period of about six hours yielded an average maximum increase of 26.2 per cent. The effect of injecting intravascularly 20 to 30 cc of an exudate into these same animals induced an increase in counts averaging 77.2 per cent. This indicates, as found previously,[3] that the LPF of exudates causes roughly a threefold increase in the absolute number of circulating leukocytes.

Dialysis of the exudative material favors the separation of the euglobulins. This fraction introduced into the circulating blood stream of dogs leaves the level of leukocytes essentially unaltered; the average increase in a series of experiments being 29.1 per cent. The residual cloudy supernatant material, after removal of the euglobulins, contains the active factor. This fraction yields in animals an average increase in leukocyte counts of 64.4 per cent. The LPF seems primarily to be associated with the pseudoglobulin fraction, for separating the albumins after treatment with $(NH_4)_2SO_4$ at half saturation fails to alter the activity of the material. The albumins *per se* induce only an average increase of 2.7 per cent. in the leukocyte count. This figure is even considerably lower than that encountered in the range of normal fluctuation. The nucleoproteins, obtained presumably by precipitation of the above supernatant cloudy material by adjusting the pH between 4.2 to 4.5 with dilute acetic acid, are likewise practically inactive.

Further studies by fractional salting out with

[1] Aided by grants from the Milton Fund of Harvard University, the International Cancer Foundation and the Dazian Foundation for Medical Research.

[2] V. Menkin, SCIENCE, 90: 237, 1939.

mmonium sulfate indicate that the leukocytosis-pro-oting factor seems primarily linked with the pseudo-obulin fraction of exudates. Precipitation of an alka-ne exudate at one third saturation with $(NH_4)_2SO_4$ ields an inactive fraction; the average increase of the hite cell counts in several experiments being 21.3 per ent. This would again support the fact that the PF is probably not a euglobulin. Treatment of the xudate with 14 per cent. Na_2SO_4 produces an inactive aterial, and thus seems likewise further to substan-ate this inference. On the other hand, the dialyzed recipitate resulting from preliminary salting out of e exudate with $(NH_4)_2SO_4$ at one-half saturation, is ighly active. The results of five experiments indicate at the average increase in the number of circulating ukocytes with this globulin fraction is 88.9 per cent. imilar fractionation of normal blood serum fails com-letely to produce any material which manifests any gmentative effect on the number of circulating leuko-ytes.

These observations, therefore, support the view that the leukocytosis-promoting factor is either a globulin or at least that it is closely linked with the pseudo-globulin fraction of exudates.[4] It is conceivable that the increase in the alpha-globulin and therefore in the high value of the α-globulin/albumin ratio recently found by Longsworth, Shedlovsky and MacInnes[5] in the blood sera of patients afflicted with various inflammatory processes, may be referable to a discharge from the site of inflammation into the circulation of the leukocytosis-promoting factor. It is to be recalled in this connection that the LPF seems to favor the outpouring of immature granulocytes from the bone marrow.[2,3] Studies are now in progress in an endeavor to purify further this globulin-like substance in exudates which *per se* offers an adequate explanation for the mechanism of leukocytosis accompanying inflammation.

VALY MENKIN[6]

HARVARD MEDICAL SCHOOL

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A NEW TECHNIC FOR STAINING VAGINAL SMEARS[1]

IN the studies from this laboratory which have dem-nstrated the value of the vaginal smear method for etecting the action of estrogenic, androgenic and onadotropic hormones in man, the staining technic mployed was the conventional hematoxylin-eosin ethod which, with the addition of waterblue as a ounterstain, was originally applied to the vaginal mear by Papanicolaou. While, as with fixed tissue, is stain is satisfactory for the morphological details f the vaginal secretion, it leaves something to be sired as regards the detection of cornification. As e extent of cornification is a measure of the degree f ovarian function and one of the most important dices in the vaginal smear, it was thought worth hile to investigate other staining methods which ight be more specific as regards this chemical cyto-lasmic change.

Of a number of methods tested, a modification of the asson trichrome stain was found to offer distinct vantages in this respect over the hematoxylin-eosin-aterblue method. Four months' experience with sev-al thousand vaginal smears taken from patients with rmal and abnormal menstrual cycles, in pregnancy, d in menopause and amenorrhea during treatment ith various sex hormones, permits me to recommend is staining procedure highly to other workers in the ld.

The advantages of the trichrome stain lie in its specific and reliable detection of cornification and in its production of a sequence of contrasting color changes in the cells under the influences of estrogens, whether endogenously produced or administered as therapeutic agents. These changes resemble a chemical titration in their sharpness. The addition of the color changes to the morphological alterations in the vaginal secretion contributes greatly to the ease and certainty of the interpretation of the smear.

The changes are seen most strikingly in menopause or amenorrhea, when, as a result of estrogenic therapy, an atrophic smear is transformed to the estrous or follicular type. The cells of the typical atrophic smear usually stain a lavender or pale blue with the trichrome stain. In less atrophic smears, the prevailing tint is a pale greenish-blue. Following the administration of estrogens, the cells, in addition to undergoing morphological changes, become progressively greener. This definite greenish coloration persists up to cornification, at which stage the cells abruptly change to a brilliant orange red. During the normal menstrual cycle, and in amenorrhea following the use of gonadotropic hormones, similar sharp transitions occur and permit the ready detection of ovulatory reactions.

3 V. Menkin, *Am. Jour. Path.*, 16: 13, 1940; "Dy-mics of Inflammation," Macmillan Company, New rk, 1940 (in press).

1 Aided by a grant from the Josiah Macy, Jr., Foun-tion.

4 The persistence, however, of a positive Molisch, along with the usual tests for proteins, in the present state of purification of the material does not preclude the possibility of a carbohydrate as a prosthetic group.

5 L. C. Longsworth, T. Shedlovsky and D. A. MacInnes, *Jour. Exper. Med.*, 70: 399, 1939.

6 With the technical assistance of Mr. M. A. Kadish and Miss Irene Lapouse.

For the composition of the trichrome stain the reader is referred to Foot's description.[2] The only modifications found desirable in adapting this stain to the vaginal smear were an increase in staining time with light green to 8 minutes and a reduction in the strength of acetic acid from the original 1 per cent. to 0.25 per cent. The acetic acid solution is made up fresh weekly. The other solutions will, with an occasional filtration to keep them clear, stain 1,200 to 1,500 slides satisfactorily. The exact procedure of staining is as follows:

(1) Fix slide while wet in 95 per cent. alcohol: ether (1:1) and carry through alcohols to water.
(2) Harris hematoxylin—2 minutes.
(3) Rinse 3–4 times in water and let stand 5 minutes in running water.
(4) Ponceau-acid fuchsin-orange G—5 minutes. Rinse 3–4 times in water.
(5) Phosphotungstic acid (3 per cent.)—10 minutes. Rinse 3–4 times in water.
(6) Light green—8 minutes. Do not wash.
(7) Acetic acid (0.25 per cent.)—3 minutes. Do not wash.
(8) Dehydrate, clear in xylol, and mount in damar.

Analysis of the action of individual components indicates the possibility of some simplification of the stain. Ponceau de xylidene, acid fuchsin and orange G were all taken up by the cornified cells and contributed to their final color. The most satisfactory staining of the cornified cells, using these dyes separately, was obtained with Ponceau de xylidene. Orange G is, however, desirable because of its staining of red cells. Phosphotungstic acid is essential because of its action as a mordant in fixing and intensifying the color produced by the preceding solution. Light green acts as a counterstain for the non-cornified cells. When used alone it will stain cornified cells a more intense green, but is unable to displace the other dyes once they have entered the cell. The staining with hematoxylin can be omitted, the nuclei then taking a red stain. Dioxane can be used instead of the alcohols as with tissue.

A more detailed description of the nuances of morphology and color revealed by this stain in smears from various normal and pathological states will be given elsewhere.

EPHRAIM SHORR

THE NEW YORK HOSPITAL AND THE DEPARTMENT OF MEDICINE, CORNELL UNIVERSITY MEDICAL COLLEGE, NEW YORK, N. Y.

[2] *Amer. Jour. Path.*, 14: 245, 1938.

A RUBBER CAST OF THE DOGFISH SPIRAL VALVE

THE spiral valve of the dogfish is a feature of most courses in comparative anatomy. It is difficult to visualize the spiral course taken by the food, and the large absorbing surface of the intestine is seldom appreciated. The structure and function of the spiral valve is well demonstrated by a rubber cast, which takes but a few minutes to make. The intestine from pylorus to rectal gland is removed from a fresh or formalin-preserved dogfish. The pyloric end is attached to a faucet and the contents completely flushed out by a slow but positive stream of water. This process is aided by gentle manipulation, and should be continued until the water is clear. After removal from the faucet the intestine is carefully squeezed to remove as much water as possible, and latex[1] is injected through the pyloric end under about 200 mm pressure. The large intestine should be tied off when latex flows out, and gentle manipulation assists the even distribution of the latex, mixing it completely with the water remaining inside. When the intestine is thoroughly turgid, the pylorus is tied off under pressure and the whole preparation hardened in 2 per cent. acetic acid for ten days. It is a simple matter to dissect away the tissue from around and between the flexible spirals, leaving a rubber cast of the interior of the intestine. The quality of the rubber improves if the cast is washed for a few hours in tap water and allowed to dry at room temperature for a day or two. The spiral may then be stretched, twisted or even unrolled without becoming permanently deformed, and is a striking demonstration specimen.

K. D. ROEDER

TUFTS COLLEGE

[1] Turtox Latex supplied by The General Biological Supply House.

BOOKS RECEIVED

ATWOOD, WILLIAM H. *Introduction to Vertebrate Zoology.* Pp. 511. 264 figures. Mosby.
CHILD, ERNEST. *The Tools of the Chemist, Their Ancestry and American Evolution.* Pp. 220. Illustrated. Reinhold. $3.50.
HAMBLY, WILFRID D. *Craniometry of New Guinea; Anthropological Series: Vol. 25, No. 3.* Pp. 83–290. 26 figures. 43 plates. Field Museum. $2.50.
Kyoto Imperial University; *Memoirs of the College of Science; Series A, May, 1939.* Pp. 41–223. Illustrated. Yen 3.80. *July, 1939.* Pp. 225–267. Illustrated. Yen 1.00. *September, 1939,* Pp. 269–35[illegible] Yen 1.00. Maruzen, Tokyo.
MYRDAL, GUNNAR. *Population, a Problem for Democracy.* The Godkin Lectures, 1938. Pp. xii + 237. Harvard Univ. Press. $2.00.
O'BRIEN, T. P. *The Prehistory of Uganda Protectorate.* Pp. xii + 319. 56 figures. 26 plates. Cambridge University Press, Macmillan. $7.50.
SVEDBERG, THE and KAI O. PEDERSEN. *The Ultracentrifuge.* Pp. x + 478. 154 figures. Oxford Univ. Press. $12.50.
WILLIAMSON, ROBERT W. RALPH PIDDINGTON, editor. *Essays in Polynesian Ethnology.* Pp. xlii + 373. [illegible] plates. Cambridge Univ. Press, Macmillan. $7.00.